Energy Efficiency Visualization in Community Planning (S489)

Sunday, April 19, 2015 • 2:30-3:45 p.m.
WSCC—Hall 6E
CM | 1.25
Our Mission

We promote smarter energy use for all.

- We give people the resources they need to make informed energy choices.

- We design and implement efficiency programs that lower costs, and protect the environment.

- We ensure the benefits of energy efficiency reach those who need them most.
Elevate Energy: Smarter Energy Use for All

- Smart grid benefits and dynamic electricity pricing in homes
  - 23,000 households enrolled in hourly pricing programs

- Energy efficient buildings
  - 3,600 single family homes retrofitted
  - 18,000 multifamily units retrofitted

- Community-level programs

- Research, policy and innovation
**Elevate Energy: Public Sector work**

- Energy & Sustainability Planning
  - Municipal
  - County
  - Regional
  - State

- Benchmarking
  - Public Sector building portfolio
  - Rollout/implementation of benchmarking ordinance

- Energy Efficiency at water/wastewater facilities
The Elevate Energy Team

A dedicated and talented team with a broad range of expertise
Agenda

- Community Sustainability Planning
- Context
- Single Family Housing Characterization
- Applications
Knowing Where Your Starting From

Community Planning - Baseline Metrics

- integral piece to an energy or sustainability strategy or larger scale plan

Municipal Energy Profile Project (MEPP)

- Developed profiles for 270 municipalities in 7 – county region (Chicago metro area)
- Energy and Emissions Data
- Residential, Commercial, Industrial
## Cook County Residential Demographics

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>1635 square miles</td>
</tr>
<tr>
<td><strong>Households</strong></td>
<td>Nearly 2 million</td>
</tr>
<tr>
<td><strong>Single family Homes (n)</strong></td>
<td>Nearly 1.1 million</td>
</tr>
<tr>
<td><strong>Size of homes (median)</strong></td>
<td>1,629 square feet</td>
</tr>
<tr>
<td><strong>Year built (median)</strong></td>
<td>1956</td>
</tr>
<tr>
<td><strong>Construction type</strong></td>
<td>Masonry 38% Frame 58% Other 4%</td>
</tr>
<tr>
<td><strong>Household annual income (median)</strong></td>
<td>$59,903</td>
</tr>
<tr>
<td><strong>Heating Systems</strong></td>
<td>85% gas forced air, 15% hot water/steam</td>
</tr>
<tr>
<td><strong>Central Air Conditioning penetration</strong></td>
<td>40%</td>
</tr>
</tbody>
</table>
Summary: Housing Stock

Single Family Homes

- 919 K
- *% Housing Units in Cook County

Data Source: Elevate Energy 2013 Analysis of Cook County Assessor 2010
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>2005 RECS, National</th>
<th>2005 RECS, East North Central</th>
<th>Elevate Energy¹</th>
</tr>
</thead>
<tbody>
<tr>
<td># Homes</td>
<td>3,102</td>
<td>486</td>
<td>440,204</td>
</tr>
<tr>
<td>kWh</td>
<td>10,757</td>
<td>9,685</td>
<td>9,273</td>
</tr>
<tr>
<td>therms</td>
<td>706</td>
<td>934</td>
<td>1,306</td>
</tr>
<tr>
<td>kBtu - electric</td>
<td>36,703</td>
<td>33,045</td>
<td>31,639</td>
</tr>
<tr>
<td>kBtu - gas</td>
<td>70,589</td>
<td>93,353</td>
<td>130,600</td>
</tr>
<tr>
<td>Square feet</td>
<td>1,889</td>
<td>2,132</td>
<td>1,254</td>
</tr>
<tr>
<td>Year built</td>
<td>Before 1940</td>
<td>Before 1940</td>
<td>1957</td>
</tr>
<tr>
<td>EUI</td>
<td>57</td>
<td>59</td>
<td>129</td>
</tr>
</tbody>
</table>

¹ CNT Energy 2011
Housing Characterization Data Collection

- Assessor: N=1.1 M
- US Census
- Utilities Gas Electric: N=439k

Energy Use Intensity
kBtu / sq ft / year

- Daily weather
  HDD
  CDD
- Audits
Cook County Single Family Residential Profile

Stock is Old, Small, and Energy Intensive

- 82% of homes built before energy codes
- Median size = 1,313 sf
- Natural Gas Use: 1,329 therms annually
  - Nearly ~2x intensive as national sample
- Electricity = 8,697 kWh annually

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Housing Characterization Analysis

Segmentation of Housing Stock

- Construction Type (frame or Masonry)
- Year built (Pre-1942, 1942-1978, Post-1978)
- Number of stories

Results

- 15 Housing Groups
- Indicators of deep retrofit and savings opportunities
Geographic Concentrations of Housing Types

Frame 1942-1978 Less than 2 stories (Group 11)

Masonry 1942-1978 Less than 2 stories no split level (Group 4)

Frame Post-1978 2 or more stories (Group 10)

Masonry Pre-1942 Less than 2 stories non split level (Group 6)

Frame Pre-1942 Less than 2 stories no split level (Group 14)

Frame 1942-1978 2 or more stories (Group 13)

Masonry Pre-1942 Less than 2 stories non split level (Group 6)

Top 6 Housing Groups
Cook County IL (n=653,820)

# of Homes
0
1 - 499
500 - 999
1000 - 2099
3000 - 13632

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Geographic Concentrations of Housing Types

Masonry Pre-1942 Less than 2 stories no split level (Group 6)

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Top 6 Housing Groups
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<table>
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<tr>
<th>Group</th>
<th># of Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1 - 499</td>
</tr>
<tr>
<td>1</td>
<td>500 - 999</td>
</tr>
<tr>
<td>2</td>
<td>1000 - 2999</td>
</tr>
<tr>
<td>3</td>
<td>3000 - 13632</td>
</tr>
</tbody>
</table>

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176,352 of these brick homes in Cook County, representing 19.2% of county’s population.
County-Wide Savings Potential

Baseline Metrics
- Masonry Pre-1942 Less than 2 stories non split level (Group 6) – 176k Homes
- Median Natural Gas Use – 1,229 Therms Annually
- Median Electricity Use – 7,849 kWh Annually

Potential Program Success (10% Penetration)
- ~17,000 Homes

Annual Savings Potential (10% Therms Savings & 7% kWh Savings)
- ~2 Mil Therms
- ~9 Mil kWh Saved
- ~20,000 metric tons CO₂e reductions
Applications: Align Efficiency w/Community Goals

- Spur economic development
- Preserve affordable housing
- Address high rates of foreclosure, vacancy
- Revitalize historic neighborhoods
- Meet climate change goals
Applications: Real Estate Transaction Process

- These data are also helping to provide energy transparency in **real estate** transactions.

- City of Chicago residential energy costs disclosure when a home is listed for sale via an MLS

- Early results promising
<table>
<thead>
<tr>
<th>Subject Property</th>
<th>Comp#1 Adjustment</th>
<th>Comp#2 Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Address:</strong></td>
<td>6501 West 182nd</td>
<td>17029 S. Oketo Avenue</td>
</tr>
<tr>
<td></td>
<td>Tinley Park, Illinois</td>
<td>Tinley Park, Illinois</td>
</tr>
<tr>
<td><strong>MLS #:</strong></td>
<td>07776697</td>
<td>077730695</td>
</tr>
<tr>
<td><strong>Status:</strong></td>
<td>Active</td>
<td>ACTV</td>
</tr>
<tr>
<td><strong>List Price:</strong></td>
<td>$210,000</td>
<td>$199,900</td>
</tr>
<tr>
<td><strong>Approx Sq. Ft:</strong></td>
<td>1050</td>
<td>1044 (1044)</td>
</tr>
<tr>
<td><strong>Energy Rating:</strong></td>
<td><img src="energy_rating" alt="EQ 74" /></td>
<td><img src="energy_rating" alt="EQ 186" /></td>
</tr>
<tr>
<td><strong># Full Baths:</strong></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Air Conditioning:</strong></td>
<td>Central Air</td>
<td>Central Air</td>
</tr>
<tr>
<td><strong>Heat / Fuel:</strong></td>
<td>Gas, Forced Air</td>
<td>Gas, Forced Air</td>
</tr>
<tr>
<td><strong>Approx Year Built:</strong></td>
<td>1979</td>
<td>1972</td>
</tr>
<tr>
<td><strong>Add More Adjustments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Adjustments:</strong></td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>Adjusted Price:</strong></td>
<td>$199,900</td>
<td>$199,900</td>
</tr>
</tbody>
</table>
Application: Approach is Being Replicated

Next Steps and Future Plans

Public Records and Census Data
- Assessor Property Records Search
- Welcome to Jefferson County Property Record System
- Address, Parcel ID, Schedule Number, Brochure Number

Monthly Bills
- High-Interval Meter Data
- Data for Automated Calibration and/or Inverse Modeling

Satellite Imagery
- Footprint, Orientation & Shading

Drive-By Infrared Thermographic Imagery
- Thermal Properties & Geometry

Floor Area, Bedrooms, Foundation Type, Year Built

Data-Driven, Physics-Based Simulation and Optimization Software

Community scale optimization

Community scale energy savings potential

Targeted deployment at scale
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